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CRS Report for Congress

Pacific Salmon and Steelhead Trout: Managing Under the Endangered Species Act

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Summary

Along the Pacific Coast, 26 distinct population segments of Pacific salmon and steelhead trout are listed as either endangered or threatened under the Endangered Species Act (ESA). Human activities have combined to greatly degrade, reduce, and eliminate fish habitat and otherwise harm populations of anadromous (sea-run) fish. In addition, natural phenomena stress fish populations and contribute to their variable abundance. Current management efforts aim to restore the abundance of ESA-listed native northeast Pacific salmonids to historic, sustainable population levels. This report summarizes the reasons for ESA listings and outlines efforts to protect ESA-listed species. This report will be updated periodically to reflect the changing situation.

Background. Pacific chinook, coho, chum, sockeye, and pink salmon as well as steelhead trout are anadromous (i.e., they live as juveniles in fresh water, migrate to the ocean to develop, and, when sexually mature, return to freshwater to spawn). While steelhead trout and Atlantic salmon can return to the sea after spawning (and may spawn again in subsequent years), Pacific salmon die after spawning once. Juvenile salmon typically reside in fresh water from a few days (pink salmon) to three years (some sockeye salmon) before migrating to the ocean, where they typically spend 1-6 years before migrating to their natal stream, as much as 900 miles or more inland. Natural phenomena — predators, droughts, floods, and fluctuating oceanic conditions — stress salmonids and contribute to the variable abundance of their populations. *El Niño*, Pacific decadal oscillation,[1] and global climate change[2] have been of particular concern as factors altering salmon habitat and affecting salmon distribution and abundance.

Precipitous salmon declines in the 1990s hurt the economies of fishing-dependent communities throughout the Northwest and northern California. By the late 1990s, west

[1] N. J. Mantua et al., "A Pacific interdecadal climate oscillation with impacts on salmon production," *Bulletin of the American Meteorological Society*, v. 78 (1997): 1069-1079.

[2] See [http://www.usgcrp.gov/usgcrp/Library/nationalassessment/10NW.pdf].

coast salmon abundance had declined to only 10-15% of what it had been in the 1800s.[3] As recently as 1988, sport and commercial salmon fishing in that region generated more than $1.25 billion for the regional economy. Since then, salmon fishing closures have contributed to the loss of nearly 80% of this region's job base, with a total salmon industry loss over the past 30 years of approximately 72,000 family wage jobs.[4]

Currently, 26 distinct population segments of five salmonid species have been listed or proposed for listing as either endangered or threatened under the Endangered Species Act (ESA, see **Table 1**).[5] While no *species* of anadromous trout or salmon is in danger of near-term extinction, individual population segments (designated as "evolutionarily significant units"[6]) within these species have declined substantially or have even been extirpated. The American Fisheries Society considers at least 214 Pacific Coast anadromous fish populations to be "at risk," while at least 106 other historically abundant populations have already become extinct.[7]

Human Activities Stressing Fish. Anadromous salmonids inhabit clean, silt-free streams of low water temperature (below 68° F) and quality estuarine nursery habitat. Human activities — logging, grazing, mining, agriculture, urban development, and consumptive water use — can degrade aquatic habitat. Silt can cover streambed gravel, smothering eggs. Poorly constructed roads often increase siltation in streams where adult salmon spawn and young salmon rear. Removal of streamside trees and shade frequently leads to higher water temperatures. Grazing cattle remove streamside vegetation and exacerbate streambank erosion. Urbanization typically brings riprap channelization and filled wetlands, altering food supplies and nursery habitat. Habitat alterations can lead to increased salmonid predation by marine mammals, birds, and other fish. Water diversions for agriculture exacerbate these problems. According to state water resource agencies, almost every water basin in Oregon, eastern Washington, and northern California is now over-appropriated (i.e., there are more legal permits for diversion than available water) during the hottest and driest months of the year.

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[3] E. Winninghoff, "Where Have All the Salmon Gone?" *Forbes* (Nov. 21, 1994), pp. 104-116.

[4] Pacific Rivers Council. The Economic Imperative of Protecting Riverine Habitat in the Pacific Northwest. Eugene, OR: January 1992; and "Statement of Glen Spain of the Pacific Coast Federation of Fishermen's Associations" in: U.S. Senate, Committee on Environment and Public Works, Subcommittee on Drinking Water, Fisheries, and Wildlife. *Endangered Species Act Reauthorization*. Hearing, June 1, 1995. Roseburg, OR: U.S. Govt. Print. Off. pp. 123-142.

[5] Table information taken from: U.S. Dept. of Commerce, National Marine Fisheries Service, "Snapshot of ESU Status" ([http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/upload/1pgr06-06.pdf], updated June 8, 2006).

[6] NMFS uses the term "evolutionarily significant unit" (ESU) as synonymous to a distinct population segment that appears to be reproductively isolated from other segments (56 *Federal Register* 58612, Nov. 20, 1991).

[7] Willa Nehlsen, Jack Williams, and James Lichatowich, "Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington," *Fisheries*, v. 16 (1991), pp. 4-21; and T. L. Slaney et al. "Status of Anadromous Salmon and Trout in British Columbia and Yukon," *Fisheries*, v. 21 (October 1996), pp. 20-35.

Dams for hydropower, flood control, and irrigation substantially alter aquatic habitat and can have significant impacts on anadromous fish. While the design of some dams is described as "fish-friendly" (e.g., Wells Dam on the Columbia River in Washington), poorly designed dams can physically bar or impede anadromous fish migrations to and from the sea, kill juveniles as they pass through a dam's turbines, and expose fish to potentially harmful gas supersaturation.[8] If delayed by dams during migration, both young and old salmon can be exposed to increased predation, to an increased risk of bacterial infections, and to higher temperatures which cause stress and sometimes death.[9] Decreased river flow can also harm juveniles by delaying their downstream migration. However, the 31 dams (i.e., hydro projects) in the Federal Columbia River Power System produce about 40% of the power in the Pacific Northwest, and the reservoirs behind these dams create a major navigable waterway as far inland as Lewiston, Idaho.

The goal of fish hatcheries, operated along the Pacific Coast since 1877, was, and continues to be, the augmentation of natural salmonid populations and the production of fish to replace those lost where dams completely blocked passage and destroyed native salmonid populations. Today, at least 80% of the salmon caught commercially in the Pacific Northwest and northern California each year come from hatcheries. In the 1970s, however, scientists discovered that some hatchery practices reduced genetic diversity in fish populations.[10] The mixing of populations by hatcheries and transplantation has generally resulted in decreased genetic fitness of wild populations and the loss of some stream-specific adaptations. Also, hatchery fish generally have lower survival rates than wild fish, and are less able to adjust to changing ocean conditions or to escape predators.

The harvest of intermingled fish populations from different watersheds presents several problems, including how to protect ESA-listed populations while promoting the harvest of abundant native and hatchery fish. Since hatcheries are often more productive than natural fish populations, managing fisheries to avoid surplus returns to hatcheries can result in overharvested natural populations. Controversy arises when managers must consider how much the harvest of abundant populations must be curtailed to protect less-abundant ESA-listed populations. Such policies can frustrate both commercial fishermen and sport anglers. ESA-listed or seriously depressed populations thus can become the limiting factor on fisheries, resulting in tens of millions of dollars in foregone fishing opportunities to avoid further depressing the weakest populations.

Protection and Restoration Efforts. The National Marine Fisheries Service (NMFS, also popularly referred to as "NOAA Fisheries") in the Department of Commerce implements the ESA for anadromous salmonids. NMFS receives a petition or initiates the process to determine whether a species or population merits listing as "endangered" or "threatened." Based on facts presented, the Secretary of Commerce decides whether the petition provides substantial information indicating that listing may be warranted. If

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[8] Water spilled from dams and passing through turbines can become supersaturated with gaseous nitrogen. Juvenile fish exposed to supersaturated conditions can develop disorienting gas bubble disease and become more susceptible to predation.

[9] G. F. Cada et al., "Effects of Water Velocity on the Survival of Downstream-Migrating Juvenile Salmon and Steelhead: A Review with Emphasis on the Columbia River Basin," *Reviews in Fisheries Science*, v. 5, no. 2 (1997): 131-183.

[10] Jack Stern, Jr., "Supplementation of Wild Salmon Stocks: A Cure for the Hatchery Problem or More Problem Hatcheries?" *Coastal Management*, v. 23 (1995), pp. 123, 140.

the Secretary decides affirmatively, a 90-day notice announcing the initiation of a status review is published in the *Federal Register*. Once the status review is completed, NMFS publishes a notice of proposed rulemaking in the *Federal Register* and seeks public comment for those species or populations NMFS believes should be listed. A final listing decision must occur within 12 months after notice publication. Once listed, NMFS is required to designate critical habitat[11] as well as develop and publish a recovery plan for the listed entity.[12] The goal of ESA listing is species recovery, defined as removal from the ESA list. (For more on the ESA process, see CRS Report RL31654, *The Endangered Species Act: A Primer*, by Pamela Baldwin, Eugene H. Buck, and M. Lynn Corn.)

When a federal activity may harm an ESA-listed salmonid, the ESA requires the federal agency to consult with NMFS to determine whether the activity is likely to jeopardize the survival and recovery of the species or adversely modify its critical habitat. In response to a federal agency's biological assessment, NMFS issues a "biological opinion" (BiOp) with an incidental "take" statement which can authorize a limited take of the species and specifies reasonable and prudent measures to minimize such taking. If NMFS issues a jeopardy opinion, it includes a reasonable and prudent alternative (RPA) which would not be expected to jeopardize the continued existence of the species. NMFS issues numerous BiOps related to salmon each year. For example, a 1995 BiOp for the U.S. Army Corps of Engineers and the Bonneville Power Administration sought to develop a biologically sound strategy to deal with salmon passage in the Columbia and Snake Rivers. The major impact of this 1995 BiOp and its 1998 supplement has been the move away from transporting the majority of juvenile salmonids downstream by truck or barge, and implementing a "spread the risk" policy which calls for an increase in spilling water and fish over dams, thus circumventing the power-producing turbines, to speed juvenile fish through the river toward the ocean with lower mortality. In 2000, the Corps completed a System Operations Review of the Columbia and Snake River hydropower system, with breaching the four lower Snake River dams being considered as one option. In December 2000, NMFS issued a revised BiOp that reviewed the strategies outlined in the 1995 and 1998 BiOps and recommended changes. This BiOp did not recommend breaching the four Lower Snake River dams, but did include steps to consider breach should the RPA fail. A revised 2004 "no jeopardy" BiOp did not include breaching and is under remand to NOAA by the Federal District Court of Oregon (although not due to breaching issues).[13]

Prior to the listing of salmonid ESUs under the ESA, the majority of conservation and habitat management efforts were conducted by individual states, tribes, and private industries. In the Columbia River Basin, the Northwest Power and Conservation Council took the lead under the 1980 Pacific Northwest Electric Power Planning and Conservation Act (P.L. 96-501), by attempting to protect salmon and their habitat while also providing economical power to the region. Although federal agencies and public utilities spend hundreds of millions of dollars on technical improvements for dams, habitat enhancement, and water purchases to improve salmon survival, some populations have continued to

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[11] There may be no critical habitat designation, if NMFS decides that it is not prudent, and the critical habitat designation may be delayed up to a year if it is not determinable. In practice, only about 20% of listed species have designated critical habitat.

[12] For information on current recovery efforts, see [http://www.nwfsc.noaa.gov/trt/index.cfm].

[13] The BiOp text may be viewed at [http://seahorse.nmfs.noaa.gov/pls/pcts-pub/sxn7.pcts_upload.summary_list_biop?p_id=14756].

decline. Recent years have seen an increased interest by state governments and tribal councils in developing comprehensive salmon management efforts. States generally seek to forestall ESA listings, or, if listings do occur, to reduce federal involvement affecting state-managed lands. With limited staff and funding to implement a wide range of programs, NMFS has encouraged integrated management efforts (i.e., habitat conservation plans) among federal, state, and tribal agencies as a powerful and necessary tool in saving listed species and avoiding future listing of additional ESUs through comprehensive recovery efforts.[14] NMFS viewed the Oregon Coastal Salmon Restoration Initiative (OCSRI), to promote comprehensive and proactive state-based recovery efforts and avoid listing coho salmon in Oregon, as precedent for federal/state/local partnerships. However, a federal court decision clarified that, to avoid an eventual listing, such plans cannot be based primarily on speculative or proposed future measures, but must instead be based on recovery measures that are enforceable or reasonably likely to occur, as, for instance, measures embodied in laws, regulations, or long-range and stable funding mechanisms.[15] With the listing of many salmonid ESUs in the Columbia River basin, management has become increasingly constrained, and new options for governance are being explored by federal, state, and tribal parties. Restoration efforts for some California salmon, including water reforms, were embodied in the Central Valley Project Improvement Act (Title XXXIV of P.L. 102-575) and the San Joaquin River Restoration Program.[16] The U.S. Fish and Wildlife Service (FWS) has coordinated plans for fish screens, fish ladders, and water pollution reduction to recover native fish populations in the Central Valley Project area.

In 1993, NMFS issued an interim policy on artificial propagation of Pacific salmon under the ESA to guide how hatcheries should be used to help recover salmonids.[17] In response to litigation, a new policy statement defined how hatchery fish are to be treated when deciding whether ESUs should be listed under the ESA.[18] In general, the policy is to recover wild populations in their natural habitat wherever possible, without resorting to artificial propagation. Washington, Oregon, and British Columbia mark hatchery coho salmon by fin clipping so that marked fish can be readily identified by fishermen as hatchery fish and selectively retained at harvest while unmarked, native fish can be released to spawn. Similar programs are underway for other species, such as chinook salmon and steelhead trout. In addition, controversy and resistance remain over suggested changes to use fishing gear more suitable to releasing wild fish unharmed after being caught inadvertently. In early 2006, NOAA began a collaborative review to identify (1) hatchery programs that are not contributing to salmon recovery and (2) ways to reduce the harvest of ESA-listed fish.[19] The FWS initiated a review of Columbia River hatcheries in May 2005.[20]

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[14] Personal communication with Garth Griffin, Branch Chief, Protected Resources Division, NMFS, Portland, OR, on May 21, 1998.

[15] Oregon Natural Resources Council v. Daley, CV-97-1155-ST (D.Or. June 1, 1998).

[16] For background information, see [http://www.usbr.gov/mp/SJRRP/index.html].

[17] 58 *Federal Register* 17573 (Apr. 5, 1993).

[18] 70 *Federal Register* 37204 (June 28, 2005).

[19] Background information is available at [http://www.hatcheryreform.us].

[20] See [http://www.fws.gov/pacific/Fisheries/Hatcheryreview/index.html].

Table 1. Status of Five Species of Pacific Coast Salmonids

Species	Population (ESU)	Status	Federal Register (FR) Citation	Pending Actions
Coho salmon (*Oncorhynchus kisutch*)	1. Central California	Endangered	1. 70 FR 37160 (June 28, 2005)	
	2. Southern Oregon/Northern CA coasts	Threatened	2. 70 FR 37160 (June 28, 2005)	
	3. Lower Columbia River/Southwest WA	Threatened	3. 70 FR 37160 (June 28, 2005)	
	4. Puget Sound/Strait of Georgia	Species of Concern	4. 69 FR 19975 (Apr. 15, 2004)	
Chinook salmon (Oncorhynchus tshawytscha)	1. Sacramento River winter-run	Endangered	1. 70 FR 37160 (June 28, 2005)	
	2. Upper Columbia River spring-run	Endangered	2. 70 FR 37160 (June 28, 2005)	
	3. Snake River fall-run.	Threatened	2. 70 FR 37160 (June 28, 2005)	
	4. Snake River spring/summer-run.	Threatened	3. 70 FR 37160 (June 28, 2005)	
	5. Central Valley spring-run	Threatened	4. 70 FR 37160 (June 28, 2005)	
	6. California coastal	Threatened	6. 70 FR 37160 (June 28, 2005)	
	7. Puget Sound	Threatened	7. 70 FR 37160 (June 28, 2005)	
	8. Lower Columbia River	Threatened	8. 70 FR 37160 (June 28, 2005)	
	9. Upper Willamette River	Threatened	9. 70 FR 37160 (June 28, 2005)	
	10. Central Valley fall and late-fall run	Species of Concern	10. 69 FR 19975 (Apr. 15, 2004)	
Chum salmon (*Oncorhynchus keta*)	1. Hood Canal summer-run	Threatened	1. 70 FR 37160 (June 28, 2005)	
	2. Columbia River	Threatened	2. 70 FR 37160 (June 28, 2005)	
Sockeye salmon (*Oncorhynchus nerka*)	1. Snake River	Endangered	1. 70 FR 37160 (June 28, 2005)	
	2. Ozette Lake	Threatened	2. 70 FR 37160 (June 28, 2005)	
Steelhead trout (*Oncorhynchus mykiss*)	1. Southern California	Endangered	1. 71 FR 834 (Jan. 5, 2006)	
	2. South-Central California Coast	Threatened	2. 71 FR 834 (Jan. 5, 2006)	
	3. Central California Coast	Threatened	3. 71 FR 834 (Jan. 5, 2006)	
	4. Upper Columbia River	Threatened	4. 71 FR 834 (Jan. 5, 2006)	
	5. Snake River Basin	Threatened	5. 71 FR 834 (Jan. 5, 2006)	
	6. Lower Columbia River	Threatened	6. 71 FR 834 (Jan. 5, 2006)	
	7. California Central Valley	Threatened	7. 71 FR 834 (Jan. 5, 2006)	
	8. Upper Willamette River	Threatened	8. 71 FR 834 (Jan. 5, 2006)	
	9. Middle Columbia River	Threatened	9. 71 FR 834 (Jan. 5, 2006)	
	10. Northern California	Threatened	10. 71 FR 834 (Jan. 5, 2006)	
	11. Oregon Coast	Species of Concern	11. 69 FR 19975 (Apr. 15, 2004)	
	12. Puget Sound	Listing proposed	12. 71 FR 15666 (Mar. 29, 2006)	NMFS proposed listing as threatened